Department of Agriculture

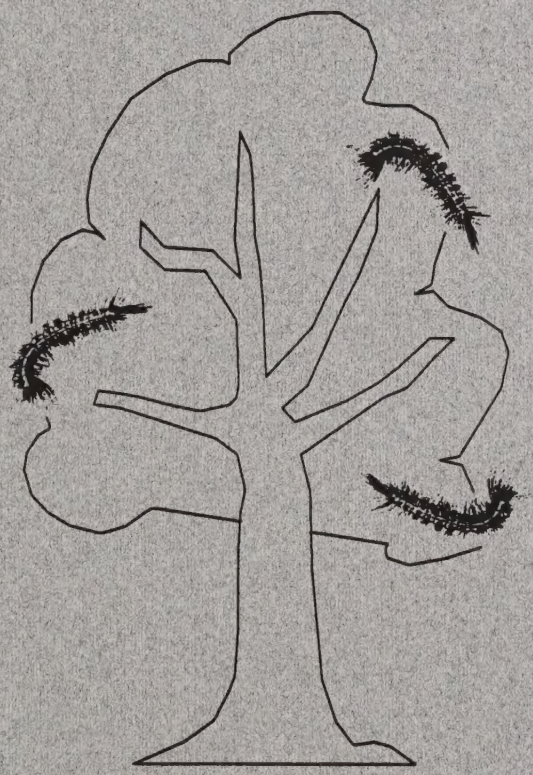
Forest Service

Forest Pest Management

Davis, CA

TACTICAL PLAN

National Steering Committee for Management of Gypsy Moth and Eastern Defoliators



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Pesticides used improperly can be injurious to human beings, animals, and plants. Follow the directions and heed all precautions on labels. Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides where there is danger of drift when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment, if specified on the label.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S Environmental Protection Agency, consult your local forest pathologist, county agriculture agent, or State extension specialist to be sure the intended use is still registered.

FPM 94-5
January 1994

Tactical Plan

National Steering Committee for Management of Gypsy Moth and Eastern Defoliators

Prepared by:

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CONTENTS

I. INTRODUCTION

Purpose

The purpose of this 5-Year Tactical Plan (Plan) is to support the FPM Technology Development process by establishing a system of identifying and developing goals and actions that support Forest Pest Management's strategic direction and goals to protect the health of America's forests (1). This plan is primarily focused on the FPM Technology Development Program. The strength of this plan lies in its national and grass roots origin participation. The committee recognizes existence of the National Center for Forest Health and its strategic planning. Unavoidably there will be some complimentary overlap with the Center's strategic plan and possibly with elements of the Missoula Technology Development Center/Forest Pest Management Program.

Background

The evolution of the FPM Technology Development Program is one of continued effort to improve its process, participation, efficiency, productivity, and accountability. Prior to establishing national steering committees in 1988 the process of managing the technology development, or special projects, was generally informal and undefined, focused on the near-term, lacked prudent accountability and was not tied to strategic goals. Given those shortcomings the program was productive while there was the need for improvement. Each year, since 1988, the FPM Technology Development Program has been improved to address emerging needs and opportunities. Support from field units and cooperators, recommendations of the FPM National Steering Committees, and coordination by WO Staff scientists have contributed to an effective FPM Technology Development Program.

The National Steering Committee for Managing Gypsy Moth and Eastern Defoliators and the other FPM National Steering Committees, were asked by the Director, FPM in 1993 to prepare 5-Year Tactical Plans. The plans are to specify short-term needs within a 5-year span that are of high priority and consistent with strategic forest health planning and actions.

At the 1993 Salt Lake City meeting the National Steering Committee for Management of Gypsy Moth and Eastern Defoliators identified 30 needs (2) and ranked them by national priority.

Program Categories

This committee identified 6 administrative program categories that cover all proposed activities within the 5-Year Tactical Plan. If the need does not fit one of these categories, it is likely beyond the scope of this committee and the plan. The categories are:

- Basic biological and taxonomical information
- Impact
- Monitoring
- IPM situation/decision models
- Control strategies
- Technology transfer and training

Within these categories, activities would include basic research, applied research, development, demonstrations, operations, and technology transfer. FPM cannot by law provide funds to support basic research, but should play a leadership role in coordinating needs with researchers and form partnerships to address research needs that affect tactical planning goals.

Format of Plan

We have chosen a format that does not include a vision or mission statement to be consistent with the Chief's direction of one Forest Service vision and mission statement. Each Goal statement is followed by a Rationale/Background that clarifies and expands upon the goal statement, explains why this goal is important, and discusses how it relates to forest health and ecosystems management. Note that goals are stated as a future desired state. This is followed by Actions to accomplish the goal. In case there is need for sub-actions, we can refer to these as Strategies in future updates of the plan. Each Action and Strategy will be assigned a date for completion with a 5-year to 7-year span as the plan is expanded. Specific years have been assigned (as the plan is developed) to some of the goals while others are assigned by Phase and/or Year-1 as an example. Initiation of action items under some goals is dependent upon insect populations, funding, and availability of other resources; or the development of information that allows us to move to other dependent actions.

II. 5-YEAR TACTICAL PLAN

GOAL 1

Data and methodology are available to determine the impact on forest ecosystems caused by gypsy moth and eastern defoliators and the pesticides used to control them.

Rationale

Since 1985, commercial formulations of the bacterium pesticide Bacillus thuringiensis var. kurstaki: (Bt) and the insect growth regulator Diflubenzuron (Dimilin), have been the products of choice by forest managers to control defoliator populations in the Eastern U.S. However, the aerial application of both products over large areas is being scrutinized both by the public and resource managers because of their perceived negative impact in particular on species of non-target Lepidoptera. The concern is not limited to threatened, endangered, and sensitive species, but also on the biodiversity of micro and macro Lepidoptera that serve as food sources for other species such as the endangered Virginia big-eared bat and the Thompson big-eared bat.

Initial studies, conducted on the effects of Bt and Dimilin on specific groups of Lepidoptera, have shown that reductions in numbers of spring-feeding Lepidoptera have occurred in sprayed blocks either in the same season or in the year after treatment. The severity of the reduction on biodiversity and long-term effects on individual species have not been ascertained. It has been observed that Dimilin persists all season; therefore impact can be expected on fall feeding insects.

Conversely, many spring and summer-feeding species of Lepidoptera could be severely impacted by lack of foliage caused by defoliation or the change in foliage quality that defoliation can induce. Minimal data exist on the effects of severe or partial defoliation on non-target organisms; however, since trees in defoliated areas fail to refoliate for 2-3 weeks, it can be perceived that at least heavy defoliation could have a significant impact on foliage feeding arthropods and on the microclimate within forest ecosystems.

If managers are to make intelligent decisions about the need to control pest species, they must have sound data on the consequences of the spray or no spray options on forest health and forested ecosystems.

Actions

- Pursue development of a risk model for impact of gypsy moth and control methods on non-target organisms.
- Evaluate impact of gypsy moth and eastern defoliators on forest ecosystems.
- Evaluate effect of Bt on non-target organisms and determine what's at risk.
- Screen western foliage for potential food source of Asian gypsy moth.
- Determine ingredients in Bt formulations and evaluate effects of ingredients on non-target organisms.
- Review literature and evaluate statistical analyses methods to support non-target data evaluations.
- What do we know about effects of Bt and Dimilin on non-target organisms?
- What are the specific data gaps and what might we need to know in the future?
- What are the components and species of the various ecosystems that we should identify and understand?
- What is the theoretical potential of eliminating a species with control activity?
- What is the recovery of organisms impacted by a control activity?
- What strategies might be used to reduce potential impact on non-target organisms?
- What is the impact of gypsy moth on various components of the ecosystem?
- How do we dispel myths within public agencies and the public that hampers sound control practices?
- How do we coordinate and manage design, support, and conduct of companion non-target impact studies in the East, West, and Canada that allow statistical comparison of result?
- How do we develop a model that predicts the potential impact of control materials and methods on non-target organisms?

(Action items to be coordinated by Mike McManus)

GOAL 2

Conventional insecticides and biorational materials, including Dimilin, are available to control suppress, or eradicate gypsy moth and/or eastern defoliators.

Rationale

Insecticide materials are viewed as resource management components for control, suppression, and eradication in case of exotic insects. Maintaining registration of current materials and registering new materials for a variety of efficacious and environmentally acceptable insecticides will: 1) assure that some products are always available and 2) offer a choice of materials for use in suppression or eradication programs. Maintaining registration of a variety of materials will offer alternatives to address environmental concerns, and provide economic options. This effort is particularly important given industries lack of economic interest in maintaining forest-use pesticides.

Actions

- Develop efficacious pheromone formulation and delivery systems.
- Continue development of fungal pathogens for gypsy moth.
- Enhance species specific viruses.
- Pursue research on inherited sterility.

(Action items to be coordinated by Sheri Smith)

GOAL 3

Up to date technologies, guidelines, and operational skills are available and being used by Federal and State agencies to control, suppress, or eradicate gypsy moth and eastern defoliators.

Rationale

The USDA Forest Service has a national leadership role to provide technology to its field units and cooperators that will continue to improve effective control, suppression, and eradication activities. With the focus on gypsy moth especially over the past two decades and the recent introduction of the Asian gypsy moth, several FS organizations have worked directly or indirectly to improve gypsy moth control efforts. These efforts, for the most part, have been successful in providing up to date technology to the field user; however improvements in control have been somewhat disappointing. It is generally recognized that technology can be more effectively delivered and practiced; and that insecticide application can be more effective, efficient, economical and efficacious if a solid technology transfer plan is jointly developed by the potential users of the technology. Actions within this Goal will explore opportunities and options that are directed toward improving technology transfer for activities, effective technology transfer to improve control, suppression, and eradication operations.

Actions

- Summarize spray canopy penetration, drift, and behavior in complex terrain, and identify data gaps.
- Investigate a model or expert system that predicts potential for natural collapse of gypsy moth populations.
- Test gypsy moth phenology models in the West.
- Evaluate efficacy and drift of insecticides applied by Rotomist, orchard air blast, and hydraulic sprayers.
- Evaluate existing data needed to determine and establish spray buffer zones.

(Action items to be coordinated by Jack Barry)

GOAL 4

State-of-the-art guidance, navigation, and monitoring system(s) are being used to guide, navigate, and monitor in real time, spray aircraft location, coverage, and spray drift.

Rationale

The USDA Forest Service uses aerial application of pesticides when warranted in eradication and suppression programs for gypsy moth. Global Positioning System (GPS) and Geographic Information Systems (GIS) technology is now available to aid in aerial application programs. The technical advantages of GPS positioning technology are:

1) Exact positioning at all times. Flight lines can be replicated within a few meters. Absolute position relative to the surface of the Earth is always known. Elevation can also be determined (elevation readings have larger error in these systems than do horizontal coordinates).

2) Exact logging of position. Aircraft position can be logged electronically so a record is available for review by the project leader and as a legal record to exactly address questions of off-target exposure. This information can also be monitored real-time by project personnel to monitor coverage and minimize costs associated with repeating operations.

3) Exact logging of block boundaries. The spray area can be programmed electronically before operations begin to ensure application to the desired area.

4) In development of alarm, monitoring and control systems. The systems can be designed to warn pilots when they are off a flight line or when they approach a block boundary. The systems can be associated with flow meters to record and/or control the exact amount of material released versus position of release. Ultimately, the positional information could be used to open and close valves so that spray on and spray off occur at preprogrammed positions.

This technology, when fully implemented, will result in substantial cost savings to the government through the reduction of block marking and monitoring costs which are currently expended in aerial application programs. Flight hours of monitoring aircraft will be reduced (eventually eliminated). Cost savings will also be realized through the rapid available real-time positional data to the pilot and project leader, allowing immediate analysis of coverage. It is likely savings will also be realized through a reduction in contentious litigation due to the explicit nature of the positional record, and material release record.

Actions -

- Evaluate and recommend guidance, navigation, and monitoring (GIS, GPS, and FSCBG model) systems to guide, navigate, tract, and monitor spray aircraft in real-time.

- Evaluate and/or develop and recommend techniques to physically and electronically mark treatment blocks.

(Action items to be coordinated by Harold Thistle)

GOAL 5

Information on conventional insecticides and biorational materials - rates, volumes, and adjuvants are available to update current knowledge and to pursue evaluation of potential materials.

Rationale

There are presently a number of insecticidal including biorational materials available for the suppression and eradication of gypsy moth (Lymantria dispar). Dimilin (Uniroyal) and Bacillus thuringiensis (Bt) (Novo, Abbott and Sandoz) are used to treat approximately 1,000,000 acres annually. Other materials such as Disrupt II (Hercon), Gypchek (USFS) and Golden Natur'l Spray Oil (Stoller) are used to treat small acreages.

A process is needed that will provide resource managers in the public and private sectors information on the availability, registration, cost, rates, and tank mix adjuvants of conventional insecticides and biorational materials for control of gypsy moth and eastern defoliators. Current information is available from a multitude of sources including Federal and provincial sources in Canada, manufacturers, Federal Laboratories, universities, scientific and trade journals applicators, and control project managers. Therefore the problem is 2-fold, we need a process to: (1) insure availability of information to people making use decisions and developing application specifications; and (2) we need a process that will insure availability of updated and new information. Win McLane, (USDA-APHIS, Otis Methods Development Center) summarized the current knowledge on conventional insecticides and biorational materials (see letter in Appendix). His letter ends with the following comments:

> "The screening of new products continues to be an on-going program at the Otis Methods Development Center, USDA, APHIS.
>
> In the future, there will be an even greater emphasis than now on the use of environmentally friendly materials for gypsy moth control. Most likely, some of the materials we can now use will be lost and safer products will be developed. If a product is to be used, drift and non-target studies will have to be conducted. These are costly and time consuming. The efficacy studies alone will be very costly for new products.
>
> It is critical that we initiate and/or continue projects over the next five years that will: 1) determine if lower rates of Dimilin can be used 2) develop workable pheromone formulations 3) establish effects of Bt and Dimilin on non-target insects and the environment 4) develop production of virus and suitable formulations and 5) identify new candidate products and develop them.
>
> We recommend that this work continue to be supported and funded over the next five years."

Actions

- Determine evaporation rates of Bt tank mixes, under different RH's, that are used to control gypsy moth.
- Summarize data on the Rohm Haus RH 5992 mimic growth regulator and recommend appropriate field testing.
- Investigate and test Dimilin - reduced rates, reduced volumes, and anti-evaporants relative to efficacy, economy, drift, and effects on non-target organisms.
- Summarize data on ultra violet degradation of Bt on foliage.
- Evaluate registered stickers for undiluted Bt formulations in the laboratory and field.
- Determine existing capabilities and future needs for DNA investigation of gypsy moth hybrids.

(Action items to be coordinated by Win McLane)

GOAL 6

Reliable monitoring and survey methods are available and being used.

Rationale

Reliable monitoring and survey methods are required to efficiently and effectively delimit insect populations. This information is vital to adequately assess the need for treatment and treatment results. Poor monitoring and survey methodology can result in ineffective treatment or an incorrect assessment of treatment acreage for control, suppression or eradication programs resulting in costly consequences. With the increased concern over treatment effects on non-target organisms, reliable survey and monitoring methodology is critical to assess and minimize non-target impacts. An effective monitoring program is particularly important for use in early detection of introduced species, like the Asian gypsy moth. Early detection of introduced pests will reduce the costs associated with expensive eradication programs, enhance treatment effectiveness, and provide a greater number of eradication strategies available to quarantine agencies for eliminating the introduced pest.

Actions

- Develop guidelines for surveying and monitoring non-target species.
- Develop pheromone monitoring procedures for Asian gypsy moth, nunn moth, and pink gypsy moth.
- Develop reliable detection/collection techniques for female Asian gypsy moth hybrids.
- Develop monitoring techniques for specific native insects that historically reach outbreak levels.

(Actions to be coordinated by Steve Munson)

REFERENCES

1. USDA Forest Service. 1993. Healthy Forests for America's Future - A Strategic Plan. US Department of Agriculture, Forest Service, Washington, DC.

2. Barry, John W. (Compiler). 1993. Sixth Report - National Steering Committee for Management of Gypsy Moth and Eastern Defoliators, FPM 93-15. USDA Forest Service, Forest Pest Management, Davis, CA.

APPENDIX A.

Win McLane -

Development of Insecticides
and Biorationals

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Subject: Development of Insecticides and Biorationals

Date: September 22, 1993

To: Jack Barry
Forest Service

There are presently a number of insecticidal and biorational materials available for the suppression and eradication of gypsy moth (*Lymantria dispar*). Dimilin (Uniroyal) and *Bacillus thuringiensis* (Bt) (Novo, Abbott and Sandoz) are used to treat approximately 1,000,000/acres annually. Other materials such as Disrupt II (Hercon), Gypchek (USFS) and Golden Natur'l Spray Oil (Stoller) are used to treat small acreage.

Other control methods such as the sterile male technique are still in the developmental stage. *Entomophaga maimaiga* research continues with its release in a number of states.

Dimilin is presently used at 0.5 ounces AI/gallon/acre. It is registered for use at 0.25 to 1.0 ounces AI per acre. Scientific data developed over the past 20 years indicate that the material can be effectively used at lower rates and volumes per acre. Certainly a rate of 0.25 ounces AI/gallon/acre could be used starting with the 1994 season.

Additional testing needs to be done before recommendations can be made for using less volume per acre. Most likely, anti-evaporants will have to be used in any Dimilin formulation applied at less than 96 ounces per acre. With present day interest in environmental concerns, it is evident that we need to continue the development of lower rates of Dimilin as well as lower volumes used per acre.

Bacillus thuringiensis is presently used at 24 BIU's per acre, applied undiluted. Over the past 15 years, rates have increased from 2 applications at 8 BIU's to single applications of 12, 16 and 20 to the present 24 BIU's per acre. Often stickers such as Bond (Loveland) or Plyac (Hopkins) are added to the Bt formulation. Over the years, poor results have caused users to increase the rate sprayed per acre. Companies have now increased their allowable rate per acre to 40 BIU's. Increased rates and multiple applications (eradication projects) of Bt may be more harmful to non-target insects and the environment than a single or double highly effective, application of Dimilin. This theory needs to be evaluated as well as the development of techniques that will make Bt more efficacious at lower rates.

Disrupt II, the gypsy moth pheromone, is applied operationally to ultra-light (0-10 egg masses per acre) gypsy moth populations at 30 grams AI per acre. Efficacy, cost and application problems have limited the use of this material. Presently, work is being conducted with bead (AgriSense) and chip (Shin Etsu) formulations of pheromone. It will be advantageous to develop these

formulations as, unlike Disrupt II, they can be applied through a regular agricultural aircraft spray system.

Gypchek's use is presently limited due to its cost ($50.00 per acre) and availability of usable formulated virus product. It is presently applied using 2 applications at 2 x 10^{11} pibs in 2 gallons per acre. In 1994, formulations with the Novo Carrier will be applied at one gallon per acre using 2 applications. Each year experimental formulation work continues as well as efforts to effectively reduce the rate and volume of application per acre. American Cyanamid are working on the production of virus and development of suitable formulations to spray.

Golden Natur'l Spray Oil has been developed (USDA, APHIS, Otis ANGB, MA) for use against gypsy moth egg masses. One hundred percent control of egg hatch can be achieved when used at a 1:1 ratio with water.

A limited amount of developmental work continues with use of the sterile male technique. This technology needs to be developed further and demonstration applications need to take place.

The screening of new products continues to be an on-going program at the Otis Methods Development Center, USDA, APHIS.

In the future, there will be an even greater emphasis than now on the use of environmentally friendly materials for gypsy moth control. Most likely, some of the materials we can now use will be lost and safer products will be developed. If a product is to be used, drift and non-target studies will have to be conducted. These are costly and time concerning. The efficacy studies alone will be very costly for new products.

It is critical that we initiate and/or continue projects over the next five years that will: 1) determine if lower rates of Dimilin can be used 2) develop workable pheromone formulations 3) establish effects of Bt and Dimilin on non-target insects and the environment 4) develop production of virus and suitable formulations and 5) identify new candidate products and develop them.

We recommend that this work continue to be supported and funded over the next five years.

Win

Win McLane, Section Leader
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APPENDIX B.

Committee Membership List

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